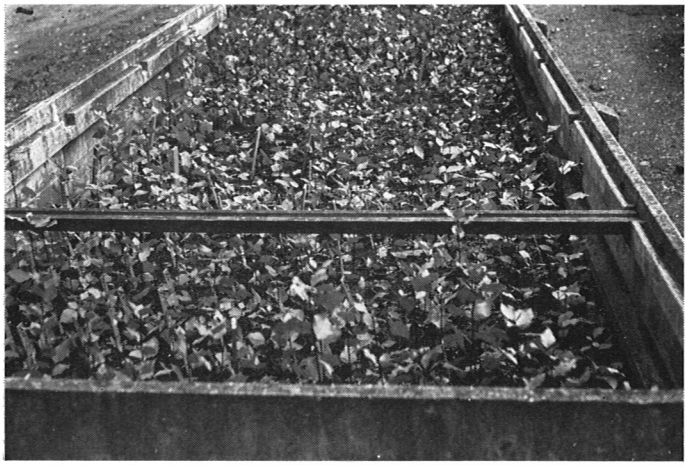

Koude bakken met populierezaailingen. Links vóór en rechts na de selectie op bladziekten.
Cold frames with poplar seedlings. Left before and right after selection for leaf diseases.

Foto's: Bosbouwproefstation

R. Koster / **Poplar breeding in the Netherlands**
Forest Research Station "De Dorschkamp", Wageningen

Introduction

The basis for poplar breeding in the Netherlands was formed by the late Professor Houtzagers. He brought order into the chaos of the taxonomy of the poplar and its multitude of clones and names.

After the war, a reasonable number of usable clones, all naturally originated Euramericans, was available for poplar growing in Holland until a new leaf disease invaded Europe about 1958. Then the usability of most clones quickly declined. Finally only 'Robusta' and 'Zeeland' remained a safe choice for the afforestation of the IJsselmeerpolders.

The breeding work started shortly after World War II when both the Department of Forestry of the Agricultural University and the Forest Research Station (founded in 1947) imported Populus deltoides seed. In addition to that the Forest Research Station made an inventory of the native poplar P. nigra whose numbers were decreasing from year to year. An extensive collection of good clones was established. The result of both activities still forms the basis of the crossing work.

At that time an intensive cooperation was also established with foreign institutes, especially with the Institute of Poplar Breeding at Geraardsbergen in Belgium and the Institute at Casale Monferrato in Italy; furthermore with various other institutes all over the world.

In controlled crosses a successful use was made of P. nigra originating from northern Italy. The clones 'Dorskamp' and 'Flevo' have resulted from those. They are highly resistant to Marssonina brunnea and rust (Melampsora larici-populina). Alongside these, three other hybrids, originating from the work of Schreiner in the US, were introduced into forestry in Holland because of their resistance to Marssonina, to wit 'Oxford', 'Geneva' and 'Androscoggin'.

The crossing programme was concentrated mainly on the production of Euramerican hybrids (the cross P. deltoides x P. nigra). However, in more recent years combinations of P. deltoides x P. trichocarpa proved to be promising as well. In autumn 1972 the mean height of 34 hybrid clones of P. deltoides x P. trichocarpa was 141.6 cm after their first year in the nursery. This was exactly 50 % more than the mean height of the 42 Euramerican clones (being 94.5 cm) in the same lot. The lack of good P. trichocarpa clones hampered the production of these new, faster growing hybrids. Fortunately this situation now starts improving.

A still newer development is initiated by crossing these hybrids (P. deltoides x P. trichocarpa) with P. nigra. Growth level and resistances of these families are promising.

Thus on the one hand there is a tendency towards a complex hybridization with the purpose of uniting the good characteristics of various species into one clone. On the other, there certainly are great possibilities for pure species. P. nigra enjoys an increasing interest not only because of its possible role in landscaping but also from conservationists. This very wind and canker resistant species is suitable for planting in the coastal area. At present there are some commercial clones of P. trichocarpa which have other good characteristics. Research will have to show, whether foreign opinions about the species also apply when it is grown in the Netherlands: P. trichocarpa is said to have the capacity to maintain a good production with minimum care and greater density than Euramerican clones do.

P. deltoides often shows an impressive growth on heavy, rather wet, rich soils. However the specific site requirements of the species are insufficiently known. This applies to the hybrid clones P. deltoides x P. trichocarpa as well. From the still very limited data one gets the impression that most hybrids will grow well on a wider variety of soil types than the pure species, with the exclusion, perhaps, of P. nigra. Probably Euramerican poplars as a group have more resistance to wind than other hybrids (but less than P. nigra).

It should be stressed that even for the pure species a good amount of breeding and selecting is needed before clones can be released which are fit for use in the field under Dutch conditions.

Crossing techniques

At the beginning of February male flower branches are collected, the pollen of which is forced in the greenhouse. In the second part of that month a beginning is made with grafting female flower twigs onto potted stocks of a commercial cultivar, e.g. 'Robusta'. These are placed in the greenhouse very early, around Christmas, so they already have nearly fullgrown leaves. The bottle graft method is used, in which the graft is put into a small bottle of water to prevent abortive loss of the catkins.

Each combination is done on three grafts of the same female clone. In total about 125 combinations are made annually, thus 375 grafts. The pollen is applied to the stigmata with a soft brush. About two months after the pollination of P. deltoides, at about the middle of May, the first seeds may be harvested (with P. trichocarpa often somewhat earlier).

The seeds are separated manually from the "fluff" and sown on wet peat slabs under double glass. Their germination follows after 1–2 days, and after 6–10 days the young seedlings are transplanted by means of tweezers into pots with garden mould; 6–8 weeks later they are put into a cold frame, at first under glass. During the rest of the summer they remain there.

Annually about 50.000 plants are produced.

Selection with a view to leaf diseases

During the generally rather wet Dutch summers the seedlings are heavily infested with leaf diseases. As there is larch growing in the nursery, the infection by rust (Melampsora larici-populina) is especially heavy, except in unusually dry summers.

After normally wet summers about 5.000 plants, after dry ones up to 20.000 plants, remain after the selection for resistance to leaf diseases (at the end of October); these are transplanted next spring into the nursery at Hees near Didam, E. of Arnhem, where Marssonina brunnea attacks poplars more intensively than elsewhere. After still another two years of selection for resistance to leaf diseases, growth and form, about 1.250 plants are left, of which 1.000 are planted elsewhere to be examined at a later stage. The 250 best plants are multiplied vegetatively for trials with bacterial canker.

Vegetative propagation

Softwood cuttings, i.e. shoot ends collected in the period from the middle of June to the middle of July, are used for the propagation of the above mentioned 250 three-year-old selected seedlings. The shoot ends with some leaves (length about 5–8 cm) are placed in cold frames under continuous mist during daytime (without covering the frame). At night the misting is stopped and the frame covered with a wooden lattice. After 6–8 weeks the cuttings have formed roots and the spraying is stopped. Next spring the rooted plants are transplanted into the nursery. Apart from some P. deltoides clones which are very difficult to get rooted, about 85 % of the cuttings in the frame develop a good root system. After one year in the open this result decreases to about 75 %.

Susceptibility to bacterial canker

New clones are tested for susceptibility to bacterial canker by inoculation with Aplanobacter populi, the bacterium which causes the disease and which was discovered by Ridé.

For the test seven one-year-old plants of each clone (on two year old roots) are inoculated in autumn. Each plant is inoculated on two leafscars obtained by picking two leaves. Two years after this inoculation the 14 resulting patches on the bark are finally judged according to a scale of 1–6. A series of standard clones well known in practice and with increasing susceptibility (approximately of 1–6) are included each year in the new test. Clones having a score 1 or 2 are considered resistant (the average score of 'Robusta' is generally 3).

Four years ago a start was made to test all older P. deltoides trees for their resistance to bacterial canker. About 500 trees were reproduced vegetatively (by softwood cuttings under continuous mist). As a result we now have identified the (few) trees among them that are resistant to canker.

Of late canker resistant P. trichocarpa clones have started to flower (for the first time in 1971). Therefore we can now combine selected canker resistant parents from both species (P. deltoides and P. trichocarpa) and also P. nigra, a very canker resistant species. It is reasonable to expect that a higher percentage of canker resistant clones can be obtained out of the yearly produced 50.000 seedlings in the near future.

The inoculation of seedlings is a new development; the method was applied to large numbers of P. deltoides seedlings derived from seed from the USA and Canada. These were all inoculated in order to single out the least susceptible fraction. These seedlings are propagated and the resulting clones will be examined in detail later as to their susceptibility to this disease. It was shown that resistance to bacterial canker is much less prevalent in northern provenances of the US than in the southern ones. Regarding the provenances from north to south there is a continuous increase of the percentage of plants resistant to canker.

Judgement of seedlings and clones in the nursery

During the nursery stage hardly any measuring is done. All judgements are made "on sight". The most important ones are those concerning growth, form, rust, Marssonina and rooting ability of cuttings (and as mentioned above, the result of the inoculation with Aplanobacter).

Judging growth without measuring not only has the advantage of being a fast method; by its nature it is based on comparison and thereby also shows the gradual differences in height growth (in youth) between a great number of clones (excellent = 1, very good = 2, good, as 'Robusta' = 3, etc.).

The leaf diseases are judged according to fixed standards. Here, too, no counting is done. Because their intensity increases in the course of the summer season the date of examining is important. The intensity of the leaf diseases also varies per nursery. Thus the nursery always is mentioned in the records.

Rooting ability is expressed as percentage (number of rooted plants per number of cuttings x 100). Of course it is important to know from which number of cuttings these data were obtained. This amount thus will be noted.

Furthermore it is important to know how homogeneous the clone is with respect to the judged characteristic. A figure 1 means extremely homogenous, etc.

All observations are recorded in punch cards and registered by means of a computer. This opens the possibility of examining correlations or of obtaining a list of all clones with a certain combination of characteristics at a moments notice.

Further trials

1 *General comparison of a great number of clones*

The first sets of trials aim at a comparison of production levels of great numbers of new clones. For this purpose new clones have to be propagated in one part of the nursery under exactly identical conditions. The simplest layout comprises four trees per clone, planted in two pairs. The advantage of pairs is that each form observation is obtained in double in one glance. In this way a maximum number of clones can be compared on a minimum area. The trial always contains one or more standard clones (anyway 'Robusta').

In order to obtain the proportion between the volume of each clone and that of 'Robusta' all volumes are calculated as being represented by the square of the mean diameter at breast height x average height (thus leaving out form figures). When this "representative volume" for 'Robusta' is put as 100 % the

Oude P. nigra bomen bij Dalfsen. *Old P. nigra trees near Dalfsen.*
Foto: Bosbouwproefstation

fastest growing clone 'Rap' shows a relative production of 300 % after six years (counting from the moment of planting the cutting).

2 *Silvicultural trials*
A limited number of the best clones out of these "general comparisons" is tested in silvicultural trials all over the country on a variety of sites. As much greater numbers of plants per clone and more replications are used, a more precise comparison of the production under various conditions will be obtained. It is expected that these trials will eventually enable us to make conclusions as to the specific site requirements of each clone.

Issuing new clones
In order to issue a new clone to practice, its cuttings are sent to NAKB, which takes care of further propagation and distribution to commercial nurseries.
Of course the use of a new clone contains an element of risk. The more extensive the trials have been, the less the risk will be.
It appears that in the Netherlands the need for new clones is so great that people are prepared to accept this risk rather than a period of waiting for the results of silvicultural trials lasting 10 to 15 years.
Thus eleven new clones have been issued in 1972 without waiting for results of silvicultural trials. Ten of these clones have been selected and issued after testing their susceptibility to leaf diseases and canker and after a number of years of "general comparison", as described above. The eleventh clone is a P. alba to be used in built up areas.
In the official list of varieties these clones are listed under the classification X (= experimental clones) with the recommendation: to be planted exclusively as a test, in order to avoid too great risks.

K. Griffioen / **Onderzoek over de eigenschappen van populierehout**

Houtinstituut TNO, Delft

Inleiding
Na de oprichting van de Nederlandse Nationale Populieren Commissie in 1948 werd al spoedig ingezien dat het niet alleen van belang was bosbouwkundig onderzoek over de populier te verrichten, maar dat het ook zeer nodig was te beschikken over technologische gegevens van het hout van deze boom.
Immers in een houtarm land als Nederland zou het populierehout een niet onbelangrijk aandeel kunnen leveren in de voorziening van de houtbehoefte, die voor het grootste deel al aangewezen was en nog steeds is op de import. Hierbij speelde natuurlijk het feit dat de populier een zeer snelgroeiende boom is een grote rol. Hij kan reeds na enkele tientallen jaren bruikbaar hout voor de industrie leveren.
Naast de reeds bekende toepassingsgebieden zou het tevens van nut zijn te weten of het hout nog voor andere doeleinden geschikt is.
In latere jaren kwam er nog een ander punt naar voren waarbij houtonderzoek gewenst was. Bij het zich steeds uitbreidende bosbouwkundig onderzoek ging men zich toeleggen op het kweken van verschillende variëteiten, ten einde die soorten te vinden die onder Nederlandse omstandigheden het beste zouden groeien, het meest weerstand zouden kunnen bieden aan allerlei ziekten en plagen en het hoogste rendement aan hout zouden leveren. Van industrieel standpunt gezien zou dit alleen zin hebben, wanneer het hout ook geschikt is voor industriële verwerking. Het zou dus van veel betekenis zijn van de betreffende soorten ook de technologische eigenschappen te kennen en wel het liefst in een zo jeugdig mogelijk stadium van de boom, zodat hiermede met de keus rekening zou kunnen worden gehouden.
Het is uiteraard duidelijk dat het in de meeste gevallen tot een compromis zal moeten komen tussen bosbouwkundige en technologische factoren.
De Nationale Populieren Commissie heeft van den beginne het

Recherches des propriétés du bois de peuplier

Résumé
La publication donne un résumé des recherches des propriétés du bois de peuplier de l'Institut du Bois TNO à Delft (Pays Bas), chargées par la Commission Néerlandaise du Peuplier.
Avec beaucoup de variétés de peuplier différentes recherches ont été effectuées sur les propriétés anatomiques, physiques, mécaniques et techniques. Aussi l'influence de la région de croissance sur ces propriétés a été étudiée.
Les recherches indiquaient qu'en général la longueur des fibres de bois et l'épaisseur de la paroi des fibres diminuaient de l'extérieur à l'intérieur et du pied à la cime du tronc d'arbre. Cela n'était pas le cas avec l'épaisseur des fibres.
En général la densité basale et la densité augmentaient du pied à la cime et en quelques cas aussi de l'intérieur à l'extérieur. La teneur en eau diminuait du pied à la cime il y a un intervalle très abrupte à la transition de l'aubier au duramen.
Le duramen a une teneur en eau plus haute qu l'aubier. La rétractibilité volumétrique diminuait quand la hauteur dans le tronc augmentait.
De la recherche il était évident que la période juvénile des variétés de peuplier variait de 8 à 12 ans.
Une étude plus profonde des propriétés du bois dans la jeune periode du peuplier est très nécessaire en vue de l'aptitude du bois adult pour des buts industriels.